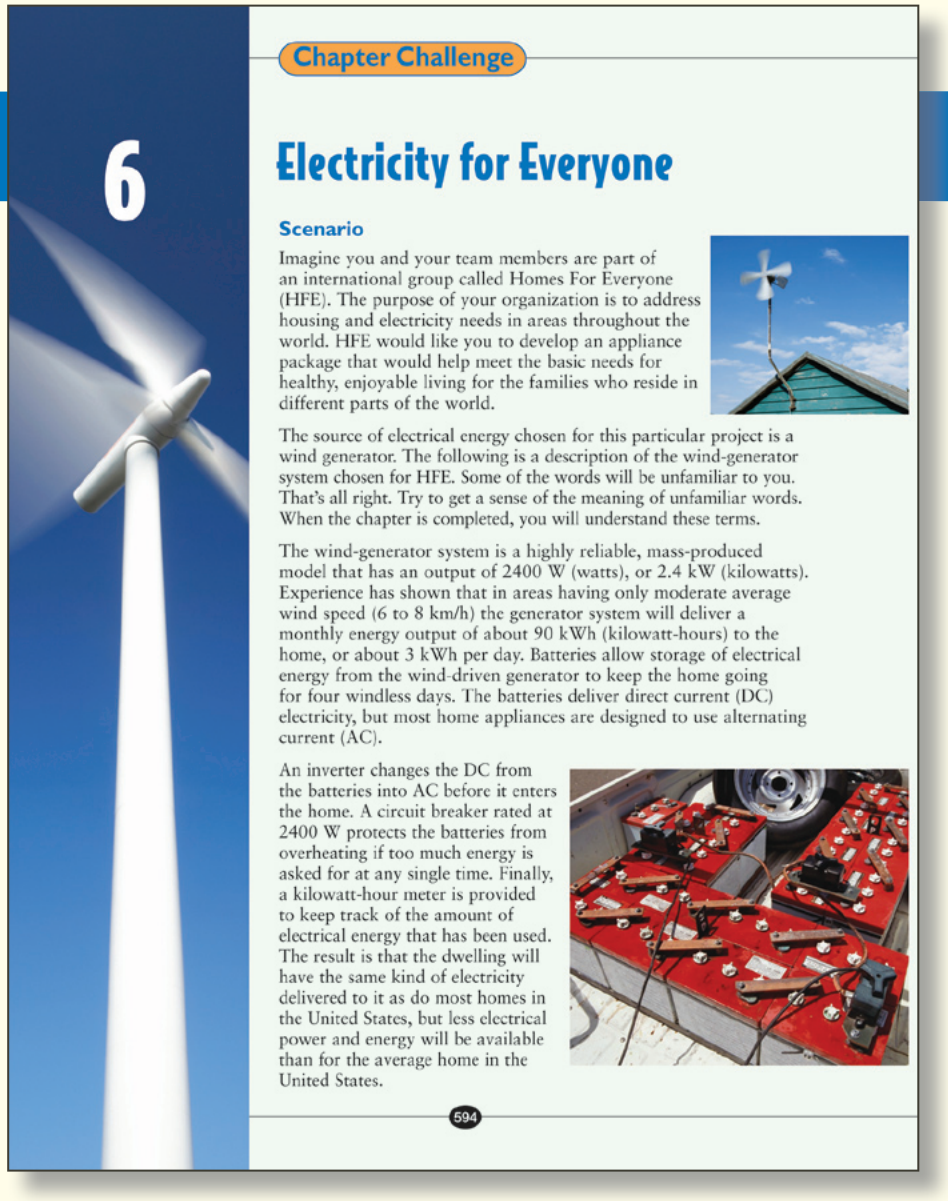
Chapter Challenge



Your Challenge

Have a class discussion about the challenge and the three tasks students are required to complete to successfully meet the challenge. Consider making a chart of the tasks and listing the criteria and constraints as shown below:

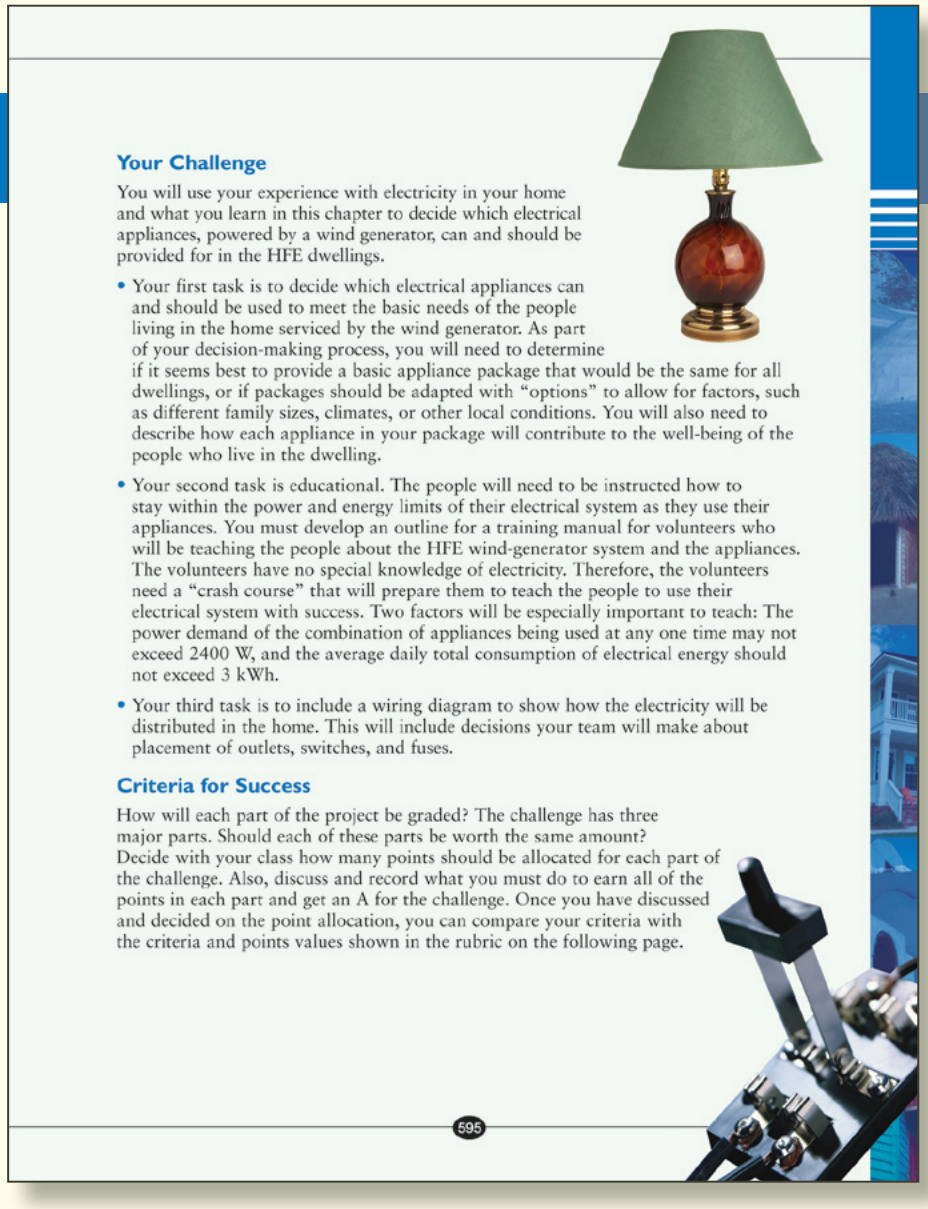
Tasks of the Chapter Challenge
Task 1 – Decide on electrical appliances included to meet basic needs. **Criteria:** Decide if one or more package should be offered, or if packages with options should be offered. Describe how each appliance contributes to the well-being of the people in the dwelling. **Constraints:** Family size or number of inhabitants in dwelling, climates, and local conditions.
Task 2 – Construct a training manual describing how to train people to stay within power and energy limits of the electrical system. **Criteria:** Manual must include educational information on how the power demand of the combination of appliances being used must not exceed 2400 W, and the average daily total consumption of electrical energy should not exceed 3 kW·h. **Constraints:** Volunteers may not have any knowledge of electricity.
Task 3 – Wiring diagram showing distribution of electricity. **Criteria:** Must include information about location of outlets, switches, and fuses. **Constraints:** Dwelling being used in.

Use the information in the *Student Edition* and emphasize the criteria and constraints of each task. Let students know that their presentation should include explanations using physics concepts.

Remind your students that as they progress through the chapter, they will become familiar with the content and will be able to connect the physics principles presented in their *Chapter Challenge*. Assure them that their understanding of each new concept will build upon the previous one and they will be provided with several opportunities to continuously improve their presentation.

Criteria for Success

Discuss the criteria for evaluating the design. Develop these criteria further to include the oral and written presentation. Then build a rubric for the class to use by recording a list of important criteria for each task of the *Chapter Challenge*. Refer frequently to the physics



Your Challenge

You will use your experience with electricity in your home and what you learn in this chapter to decide which electrical appliances, powered by a wind generator, can and should be provided for in the HFE dwellings.

- Your first task is to decide which electrical appliances can and should be used to meet the basic needs of the people living in the home serviced by the wind generator. As part of your decision-making process, you will need to determine if it seems best to provide a basic appliance package that would be the same for all dwellings, or if packages should be adapted with "options" to allow for factors, such as different family sizes, climates, or other local conditions. You will also need to describe how each appliance in your package will contribute to the well-being of the people who live in the dwelling.
- Your second task is educational. The people will need to be instructed how to stay within the power and energy limits of their electrical system as they use their appliances. You must develop an outline for a training manual for volunteers who will be teaching the people about the HFE wind-generator system and the appliances. The volunteers have no special knowledge of electricity. Therefore, the volunteers need a "crash course" that will prepare them to teach the people to use their electrical system with success. Two factors will be especially important to teach: The power demand of the combination of appliances being used at any one time may not exceed 2400 W, and the average daily total consumption of electrical energy should not exceed 3 kWh.
- Your third task is to include a wiring diagram to show how the electricity will be distributed in the home. This will include decisions your team will make about placement of outlets, switches, and fuses.

Criteria for Success

How will each part of the project be graded? The challenge has three major parts. Should each of these parts be worth the same amount? Decide with your class how many points should be allocated for each part of the challenge. Also, discuss and record what you must do to earn all of the points in each part and get an A for the challenge. Once you have discussed and decided on the point allocation, you can compare your criteria with the criteria and points values shown in the rubric on the following page.

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principles that will be visited in this chapter. Each criterion should incorporate accurate and clear explanations. Student opinion during this discussion should be encouraged as it will facilitate an understanding of the assessment criteria being developed. Include the criteria listed in the *Standard for Excellence* and read them aloud to your class. This may bring up other interesting points that could be used to reinforce or modify the criteria presented in the *Student Edition*.

After the class has agreed on each criterion, develop a rubric with the class for grading the challenge. Consider asking students what details of the challenge are necessary and how many points each part should carry. The rubric should emphasize an understanding of physics concepts as the criteria in the *Student Edition*. Aesthetic qualities of the report or presentation should have fewer points and more points should be given for physics principles that are well-explained. Students must understand the criteria and the rubric before they begin their work. Consider using the Blackline Master of the *Standard for Excellence* table, provided in your *Teacher Resources CD*, while guiding the class discussion.

1-1b Blackline Master

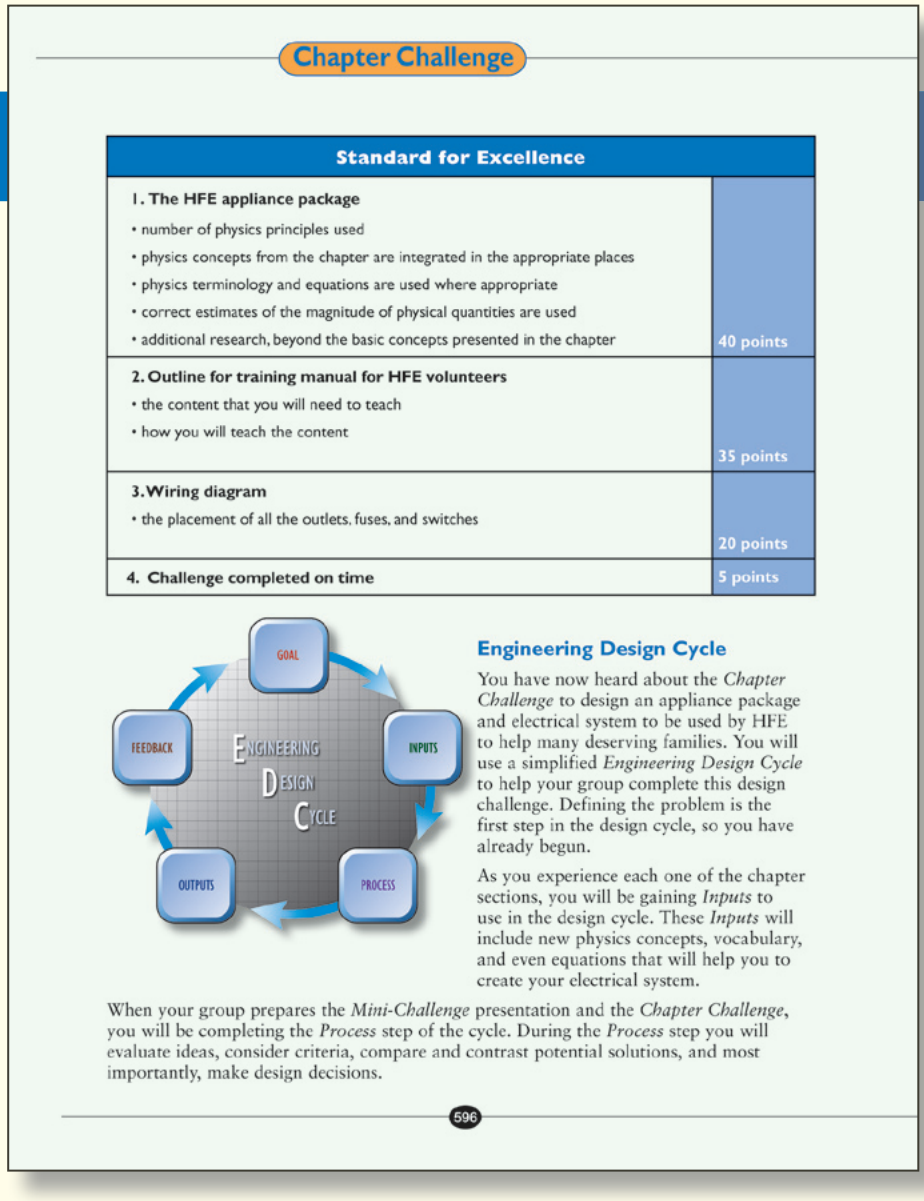
CHAPTER 6

Chapter Challenge

Standard for Excellence

Students should decide on the criteria for grading the *Chapter Challenge*. This will give them a voice in determining how their projects will be judged. A few criteria assigned with point values are listed in the *Standard for Excellence* table. Outline important aspects of the *Chapter Challenge* while the class is deciding on the criteria. Remember the primary purpose of establishing the criteria necessary to earn an "A" is to boost student motivation and keep them focused.

As the *Chapter Challenge* approaches, revise the rubric developed by your class for a more comprehensive assessment that meets your expectations. As an example, a complete *Sample Assessment Rubric* for *Electricity for Everyone* is provided at the end of the chapter in this *Teacher's Edition*.



Chapter Challenge

Standard for Excellence	
1. The HFE appliance package • number of physics principles used • physics concepts from the chapter are integrated in the appropriate places • physics terminology and equations are used where appropriate • correct estimates of the magnitude of physical quantities are used • additional research, beyond the basic concepts presented in the chapter	40 points
2. Outline for training manual for HFE volunteers • the content that you will need to teach • how you will teach the content	35 points
3. Wiring diagram • the placement of all the outlets, fuses, and switches	20 points
4. Challenge completed on time	5 points

Engineering Design Cycle

You have now heard about the *Chapter Challenge* to design an appliance package and electrical system to be used by HFE to help many deserving families. You will use a simplified *Engineering Design Cycle* to help your group complete this design challenge. Defining the problem is the first step in the design cycle, so you have already begun.

As you experience each one of the chapter sections, you will be gaining *Inputs* to use in the design cycle. These *Inputs* will include new physics concepts, vocabulary, and even equations that will help you to create your electrical system.

When your group prepares the *Mini-Challenge* presentation and the *Chapter Challenge*, you will be completing the *Process* step of the cycle. During the *Process* step you will evaluate ideas, consider criteria, compare and contrast potential solutions, and most importantly, make design decisions.

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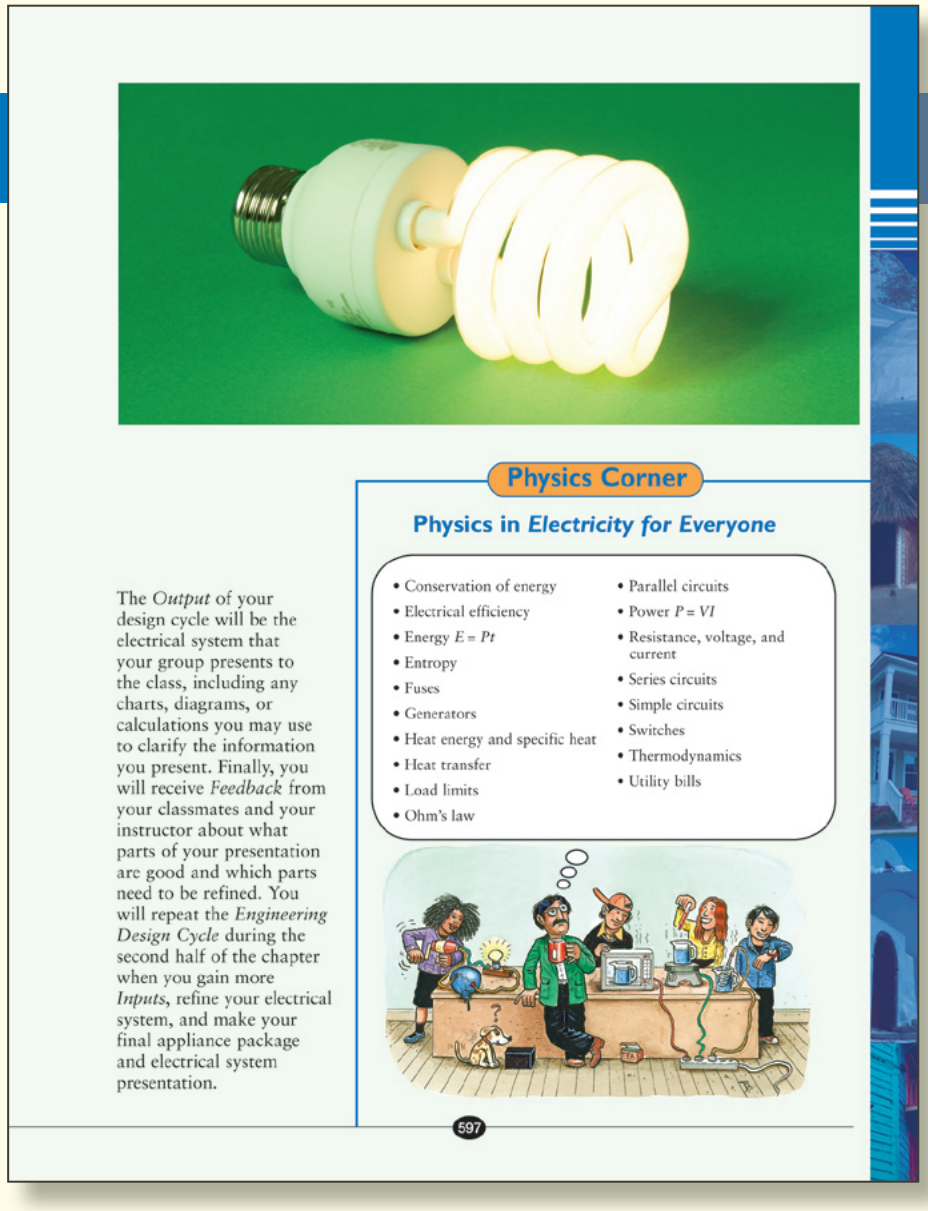
Engineering Design Process

Discuss the *Engineering Design Cycle* with your class. Consider using a projection of the *Engineering Design Cycle* to focus the discussion. Discuss each part of the cycle and point out that the class will be going through this cycle after the first half of the chapter. During the discussion ask students to provide specific examples of each step. Students must at first define the problem involved in designing an appliance package and electrical system. Discuss how students should first set their *Goal*, using the criteria and then consider the *Inputs* they receive after each section. Emphasize that these *Inputs* will be important physics concepts that they will be applying to complete their design. The *Process* step will combine students' ideas with the criteria of the challenge to compare and contrast potential solutions. Emphasize that all students will be required to provide *Feedback* on the *Outputs* during the *Mini-Challenge*. Reiterate that the *Feedback* from the *Mini-Challenge* will be used by them to refine their design of the electrical system and appliance package before the *Chapter Challenge* is completed, so that they can make their final design decisions.



Physics Corner

Physics in *Electricity for Everyone*

- Conservation of energy
- Electrical efficiency
- Energy $E = Pt$
- Entropy
- Fuses
- Generators
- Heat energy and specific heat
- Heat transfer
- Load limits
- Ohm's law
- Parallel circuits
- Power $P = VI$
- Resistance, voltage, and current
- Series circuits
- Simple circuits
- Switches
- Thermodynamics
- Utility bills

The *Output* of your design cycle will be the electrical system that your group presents to the class, including any charts, diagrams, or calculations you may use to clarify the information you present. Finally, you will receive *Feedback* from your classmates and your instructor about what parts of your presentation are good and which parts need to be refined. You will repeat the *Engineering Design Cycle* during the second half of the chapter when you gain more *Inputs*, refine your electrical system, and make your final appliance package and electrical system presentation.

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Physics Corner

The illustration in the *Student Edition* shows students involved in scientific inquiry. Some students might know the concepts they are about to study. Ask them if they can define these terms and which image illustrates a physics concept. Do not teach vocabulary. Students' ideas will give you clues on how concepts can be reviewed later based on how their prior understanding. Remind them that will be applying these concepts later to complete their *Chapter Challenge*, and they will need to incorporate these in their final presentation. An overhead of the *Physics Corner* should help you guide a class discussion.

Students are motivated as active learners. As the *Chapter Challenge* approaches, ask them to review the *Physics Corner*, so that they can keep track of the physics they learn.

CHAPTER 6